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Innovation in Selected Industries Serving the Mining and Forestry Sectors: Results from the Survey of Innovation 2003

2001-2003

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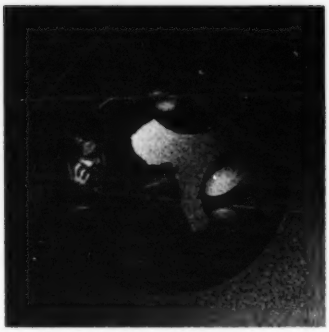

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Innovation in Selected Industries Serving the Mining and Forestry Sectors: Results from the Survey of Innovation 2003

2001-2003

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Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

The Science and Innovation Information Program

The purpose of this program is to develop **useful indicators of science and technology activity** in Canada based on a framework that ties them together into a coherent picture. To achieve the purpose, statistical indicators are being developed in five key entities:

- **Actors**: are persons and institutions engaged in S&T activities. Measures include distinguishing R&D performers, identifying universities that license their technologies, and determining the field of study of graduates.
- **Activities**: include the creation, transmission or use of S&T knowledge including research and development, innovation, and use of technologies.
- **Linkages**: are the means by which S&T knowledge is transferred among actors. Measures include the flow of graduates to industries, the licensing of a university's technology to a company, co-authorship of scientific papers, the source of ideas for innovation in industry.
- **Outcomes**: are the medium-term consequences of activities. An outcome of an innovation in a firm may be more highly skilled jobs. An outcome of a firm adopting a new technology may be a greater market share for that firm.
- **Impacts**: are the longer-term consequences of activities, linkages and outcomes. Wireless telephony is the result of many activities, linkages and outcomes. It has wide-ranging economic and social impacts such as increased connectedness.

The development of these indicators and their further elaboration is being done at Statistics Canada, in collaboration with other government departments and agencies, and a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a limited picture of science and technology in Canada. More measures were needed to improve the picture.

Innovation makes firms competitive and we are continuing with our efforts to understand the characteristics of innovative and non-innovative firms, especially in the service sector that dominates the Canadian Economy. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries that lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

The federal government is a principal player in science and technology in which it invests over five billion dollars each year. In the past, it has been possible to say only *how much* the federal government spends and *where* it spends it. Our report **Federal Scientific Activities, 1998 (Cat. No. 88-204)** first published socio-economic objectives indicators to show *what* the S&T money is spent on. As well as offering a basis for a public debate on the priorities of government spending, all of this information has been used to provide a context for performance reports of individual departments and agencies.

As of April 1999, the Program has been established as a part of Statistics Canada's Science, Innovation and Electronic Information Division.

The final version of the framework that guides the future elaboration of indicators was published in December, 1998 (**Science and Technology Activities and Impacts: A Framework for a Statistical Information System,** Cat. No. 88-522). The framework has given rise to **A Five-Year Strategic Plan for the Development of an Information System for Science and Technology** (Cat. No. 88-523).

It is now possible to report on the Canadian system on science and technology and show the role of the federal government in that system.

Our working papers and research papers are available at no cost on the Statistics Canada Internet site at http://www.statcan.ca/cgi-bin/downpub/research.cgi?subject=193.

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Executive Summary

Incidence and types of innovation

More than one quarter establishments in each of the selected industries serving the mining and/or forestry sectors were innovative. "Environmental consultant" establishments have the highest percentage of innovators, with 67% reporting innovations. The other three industries reported that around 30% of all establishments were innovative.

Novelty of innovation

More than one in five innovative establishments in the selected industries serving the mining and/or forestry sectors had Canada-first innovations and at least one in ten had a world-first innovation. Amongst the five selected industries serving the mining and/or forestry sectors, "Other support activities for mining" had the highest percentage of innovative establishments with Canada-first innovations at 84% and the highest percentage of world-first innovations, at almost half of the innovative establishments in this industry.

Innovation activities

Acquisition of equipment and machinery with improved performance and training were the most frequently indicated innovative activities for establishments in selected industries serving mining and/or forestry sectors.

Sources of information and collaboration

Amongst the internal sources of information, management staff is indicated as an important internal source of information for innovation by the highest percentage of innovative establishments in all five industries examined.

Suppliers of software, hardware, materials or equipment as well as clients and customers are the two external sources of information indicated as being important by the highest percentage of innovative establishments in each of the five industries.

Problems and obstacles to innovation

Amongst the three categories of factors, economic factors (as opposed to internal or other factors) were indicated by the highest percentage of innovative establishments as important problems and obstacles.

Impacts of innovation

Allowing firms to keep up with competitors was amongst the top three impacts for all of the selected industries serving the mining and/or forestry sectors. Other frequently indicated impacts were improved quality of products (goods or services), increased ability to adapt flexibly to different client demands, increased productivity and increased profitability.

Reasons firms do not innovate

Lack of market demand was the reason chosen by the largest percentage of non-innovative establishments in selected industries serving the mining and/or forestry sectors to indicate why they did not innovate.

Preface

Innovation and the adoption and dissemination of technologies and practices are vital to economic growth and development. It is through innovation that new products are introduced to the market, new production processes are developed and introduced, and organisational changes are made. Through the adoption of newer, more advanced, technologies and practices, industries can increase their production capabilities, improve their productivity, and expand their lines of new goods and services.

In 1993, the first survey of innovation and the adoption of advanced technologies in the Canadian manufacturing sector was carried out at Statistics Canada. It was followed in 1996 by a survey conducted by the Science, Innovation and Electronic Information Division (SIEID) of innovation in the communications, financial services and technical business services industries. The Survey of Innovation, 1999 surveyed manufacturing and was the first innovation survey of selected industries serving the mining and/or forestry sectors. The Survey of Innovation, 2003 concentrated on innovation activities in selected service industries, including all of the service industries in information communication technology, selected professional services, selected transportation services and selected industries serving the mining and/or forestry sectors.

The SIEID carried out biotechnology surveys in 1996, 1997, 1999, 2001 and 2003 which examined both the development of new biotechnology products and processes and the use and planned use of biotechnologies. The 2003 Bioproducts Development survey was also conducted. The 1999 Survey of Innovation, Advanced Technologies and Practices in the Construction and Related Industries was the first survey of the innovation and advanced technologies and practices in the construction sector. A number of surveys have focused on the use and planned use of advanced technologies and practices: surveys of advanced manufacturing technologies were carried out in 1987, 1989, 1993 and 1998; and surveys of the use and planned use of information and communication technologies have been carried out annually since 1999.

This working paper, on innovation in selected industries serving the mining and/or forestry sectors, is one of a series of four descriptive working papers which provide an overview of the results of the Survey of Innovation 2003, and is part of a series of products that will present and analyse the data from this survey.

Introduction

Innovation may be thought of as the transformation of knowledge into economic activity, a continuum running from invention to commercialization (bringing the new product to the market or the new process to the workplace). From this perspective, innovation performs a vital role contributing to economic growth and development. Through innovation, new products are introduced into the marketplace, new production processes are developed and organizational changes are made.

This paper is divided into five sections and appendices. The first section will examine the nature of innovation; the second will describe how innovation takes place. The third section will explore factors that may impact the decision to innovate such as obstacles and incentives. The fourth section will examine the impacts of innovation. The fifth section will look at why some firms chose not to innovate. Finally, tables containing estimates with reliability measures for all data included in this paper will be presented in an appendix, as well as an official description for each of the industries covered in this paper.

The Survey of Innovation 2003

The data used in this paper are from the Survey of Innovation 2003. The Survey of Innovation 2003 is the second survey of innovation to examine the natural resource sector. Selected industries engaged in harvesting, extraction and related manufacturing industries were surveyed as part of the Survey of Innovation, 1999[1].

This survey was conducted pursuant to the guidelines set out in the Oslo Manual[2]. The target population for the Survey of Innovation 2003 was establishments operating in Canada in selected service industries including all ICT[3] industries in the service sector; selected knowledge-based "Professional, scientific and technical services" industries; selected "Industries serving the mining and/or forestry sectors"; and selected "Transportation industries". To reduce the response burden on small businesses, only establishments with at least 15 employees and at least $250,000 in revenues[4] were considered in sample selection[5].

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1. Anderson, Frances and Susan Schaan (2003), "Innovation in the Forest Sector", *Forestry Chronicle*, Volume 78, pp. 60-63 and Schaan, Susan (2003), "An Innovation System for the Forest Sector" in Gault, Fred (Ed.), *Understanding Innovation in Canadian Industry*. Montreal and Kingston: McGill-Queen's University Press, pp. 367-386.
2. OECD/Eurostat (1997), *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data (Oslo Manual)*. Paris: OECD
3. The definition of Information and communications technology (ICT) industries is found on the Statistics Canada web site: http://www.statcan.ca/english/Subjects/Standard/spec-aggreg/ict-2002/ict02-menu.htm.
4. Revenues and number of employees were obtained from Statistics Canada's Business Register, December 2002.
5. Details on the Survey of Innovation 2003 are available on the Statistics Canada web site: http://www.statcan.ca/english/sdds/4218.htm

The questionnaire was directed to establishments. "The establishment is the level at which the accounting data required to measure production is available (principal inputs, revenues, salaries and wages). The establishment, as a statistical unit, is defined as the most homogeneous unit of production for which the business maintains accounting records from which it is possible to assemble all the data elements required to compile the full structure of the gross value of production (total sales or shipments, and inventories), the cost of materials and services, and labour and capital used in production."[6] In the questionnaire, establishments were referred to as "business units" as this terminology was found to be more familiar to respondents completing the survey. Establishments were also asked whether or not they belonged to larger firms, which corresponds to the statistical concept of the enterprise.

Industries serving the Mining and Forestry Sectors

The NAICS classification contains two natural resource sectors, "Agriculture, forestry, fishing and hunting" and "Mining and oil and gas extraction". From these sectors three industries[7] have been included in the Survey of Innovation 2003: "Support Activities for Forestry", "Contract Drilling (except Oil and Gas)" and "Other Support Activities for Mining"[8].

In addition, establishments in the Survey of Innovation 2003 were asked to indicate the percentage of total revenues they received from sales to the mining or forestry and/or forest products industries. Most industries indicated some establishments with sales to mining and/or forestry and/or forest products industries. Twelve industries reported that at least one third of all establishments had some sale to these industries. These twelve industries included the three natural resource industries above plus five transportation industries, three professional, scientific and technical services industries and one ICT service industry (Table 1).

This working paper will examine innovation in the three NAICS natural resource industries, "Support Activities for Forestry", "Contract Drilling (except Oil and Gas)" and "Other Support Activities for Mining", and also "Environmental consulting services". These industries will be referred to as selected industries serving the mining and forestry sector. Information regarding innovation in transportation and professional, scientific and technical services industries is available in the working papers entitled *Innovation in Transportation Industries: Results from the Survey of Innovation 2003*[9] and *Innovation in Professional, Scientific and Technical Services Industries: Results from the Survey of Innovation 2003*[10].

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6. Source: http://www.statcan.ca/english/concepts/stat-unit-def.htm
7. For detailed descriptions of all industries covered by this working paper, see Appendix I.
8. Note that the proportion of establishments in this industry reporting sales to mining seems low. Upon investigation it was determined that this was the result of the inclusion of prospecting firms which may not report sales to mining industries in a given year.
9. Lonmo, C., Innovation in Transportation Industries: Results from the Survey of Innovation 2003, Statistics Canada, 2005, Catalogue No.88F0006XIE-No. 014
10. Lonmo, C., Innovation in Professional, Scientific and Technical Services Industries: Results from the Survey of Innovation 2003, Statistics Canada, 2005, Catalogue No.88F0006XIE-No. 013

Table 1: Percentage of establishments with sales to the mining and/or forestry industries, by industry, 2003

Industry	Mining (%)	Forestry (%)	Mining and/or forestry (%)
Support Activities for Forestry	6.6	89.6	89.6
Contract Drilling (except Oil and Gas)	82.5	2.5	82.5
Environmental Consulting Services	52.8	46.3	64.8
Air Transportation	36.7	1.0	53.1
Rail Transportation	26.5	47.1	52.9
Other Support Activities for Mining	44.6	5.4	47.3
Port and Harbour Operations	23.3	40.0	46.7
Satellite telecommunications	45.5	38.4	45.5
Water Transportation	24.7	39.8	45.2
Truck Transportation	12.9	38.6	41.6
Testing Laboratories	29.6	30.2	40.2
Engineering Service	23.5	23.2	34.9
Electronic and Precision Equipment Repair and Maintenance	16.7	23.0	27.0
Computer, Computer Peripheral and Pre-Packaged Software Wholesaler-Distributors	18.6	20.6	26.1
Interurban and rural bus transportation	25.6	25.6	25.6
Office Machinery and Equipment Rental and Leasing	20.0	20.0	25.0
Surveying and Mapping (except Geophysical) Services	20.3	12.7	24.6
Wired Telecommunications	15.8	21.1	22.4
Geophysical Surveying and Mapping Services	14.7	7.4	18.9
Data processing, hosting and related services	10.5	11.6	18.6
Other Machinery, Equipment and Supplies Wholesaler-Distributors	11.5	16.0	17.9
Other Scientific and Technical Consulting Services	10.7	12.2	16.8
Software Publishers	8.9	15.2	16.7
Management Consulting Services	7.4	13.1	15.2
R&D in the Physical, Engineering and Life Sciences	9.6	10.9	12.8
Industrial Design Services	8.9	6.7	11.1
Computer Systems Design and Related Services	3.1	7.5	10.5
R&D in the Social Sciences and Humanities	5.6	5.6	8.9
Telecommunications resellers	7.4	7.4	7.4
Wireless Telecommunications	2.9	6.7	6.7
Airport Operations	1.7	5.0	6.7
Internet Service Providers	0.0	3.0	3.0
Cable and other program distribution	0.0	2.1	2.1
Other telecommunications	0.0	0.0	0.0
Web search portals	0.0	0.0	0.0

Source: *Statistics Canada, Survey of Innovation 2003*

Selected industries serving the mining and/or forestry sectors were sampled, with 368 sampled establishments representing a total of 518 establishments. Table 2 contains a detailed breakout of population, sample and response rate by industry.

Table 2: Population, sample and response rate for establishments in selected industries serving the mining and/or forestry sectors, 2003

NAICS (2002)	Description	Population	Sample	Response rate
1153	Support activities for forestry	255	138	79.1%
213117	Contract drilling (except oil and gas)	49	49	70.0%
213119	Other support activities for mining	94	94	73.3%
54162	Environmental Consultants	120	87	73.8%

Source: *Statistics Canada, Survey of Innovation 2003*

1. What is innovation?

Innovation combines invention and discovery with practical application, either by bringing the invention to the market or to the workplace. The Oslo Manual[11] outlines proposed guidelines for collecting and interpreting innovation data and allows the production of internationally comparable, meaningful indicators of innovation. The manual identifies two types of technological innovation — product innovation and process innovation.

An innovative firm is one that has introduced a new or significantly improved product onto the market or introduced a new or significantly improved process into the production process during the previous three years.

In the case of product innovation, the product must be new to the establishment and it must have been introduced to the market, and not simply be ready for introduction to the market. The term "product" includes both goods and services. Complex products may be innovative as a result of changes to one of the components or subsystems. Changes to a firm's existing products that are purely aesthetic, or that involve only minor modifications, are not considered to be innovations.

A process innovation must have been actually used within the production process. New or significantly improved processes are those that are new to the firm. The outcome of process innovation should be significant with respect to the level of output, quality of products (goods or services) or costs of production and distribution. Minor or routine changes to processes are not to be included. The term "process" also includes improved ways of delivering goods or services.

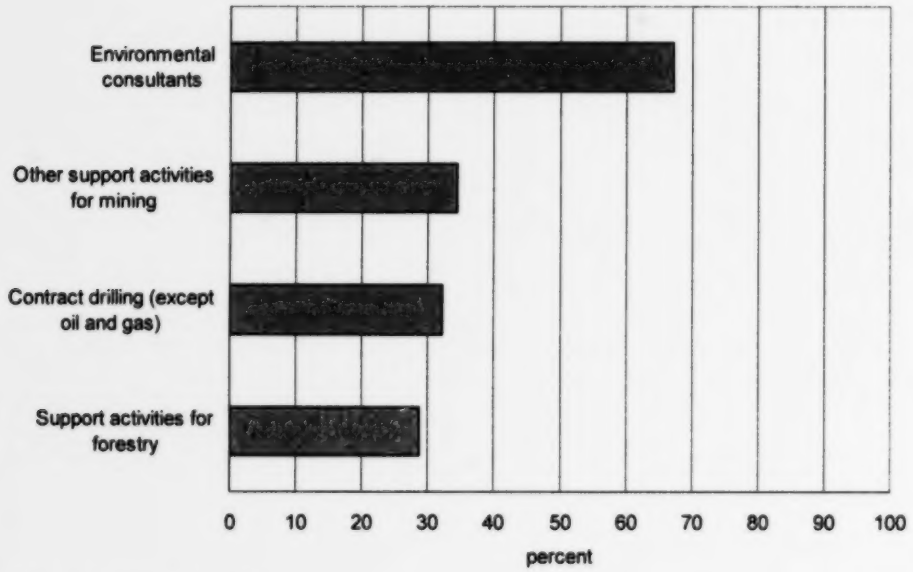
This section will look at the percentage of innovators, the type of innovation being undertaken and the degree of novelty of innovations in selected industries serving the mining and/or forestry sectors.

11. OECD/Eurostat (1997), *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data (Oslo Manual)*. Paris: OECD

Rates of innovation

More than one quarter establishments in each of the selected industries serving the mining and/or forestry sectors were innovative (Figure 1), in other words, they introduced a new or significantly improved product or process during the period 2001 to 2003. "Environmental consultant" establishments have the highest percentage of innovators, with 67% reporting innovations. The other three industries reported around 30% of all establishments were innovative.

Figure 1
Percentage of innovative establishments, 2001 to 2003

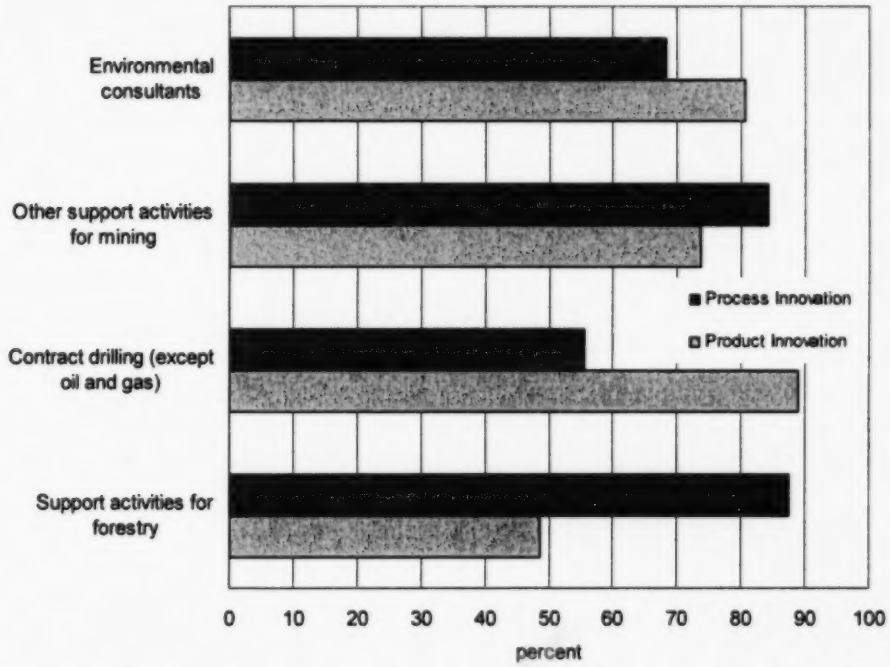


Source: *Appendix II, table 1A*

Type of innovation

Innovative establishments in "Contract drilling (except oil and gas)" reported more product innovation, while innovative establishments in "support activities for forestry" reported more process innovation. The other two selected industries serving the mining and forestry sectors reported levels of product and process innovation that were similar.

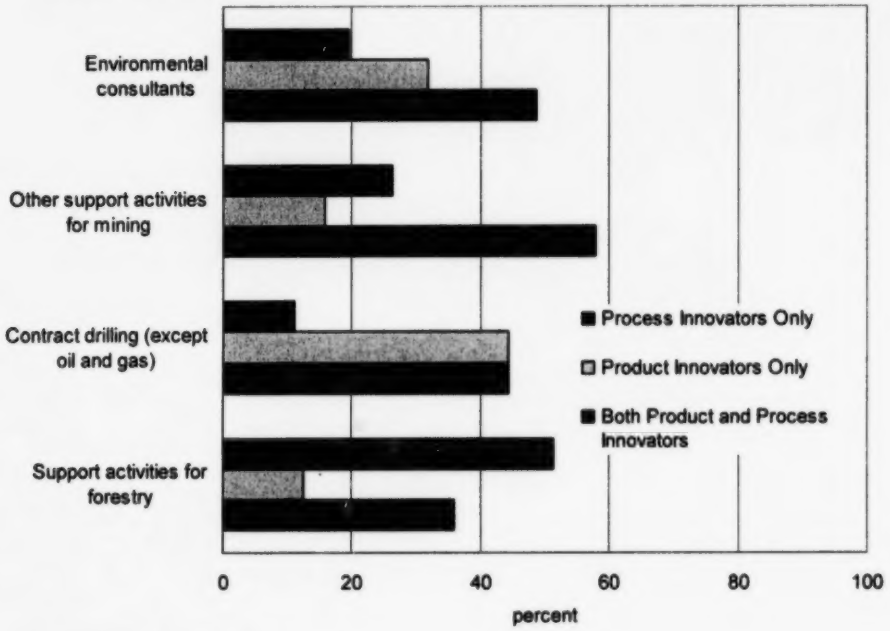
Figure 2
Type of innovation introduced by innovative establishments in selected industries serving the mining and/or forestry sectors, 2001 to 2003



Source: *Appendix II, table 2A*

When examined in terms of whether establishments are engaged in process innovation only, product innovation only or both product and process innovation, each industry displays a different profile. Establishments that were "Environmental consultants" or in "Other support activities for mining" were most likely to be both product and process innovators, while "Support activities for forestry" reported more process only innovators and "Contract drilling (except oil and gas)" reported equal proportions of establishments who were product only innovators and both product and process innovators.

Figure 3
Type of innovation produced by innovative establishments, 2001 to 2003



Source: *Appendix II, table 2A*

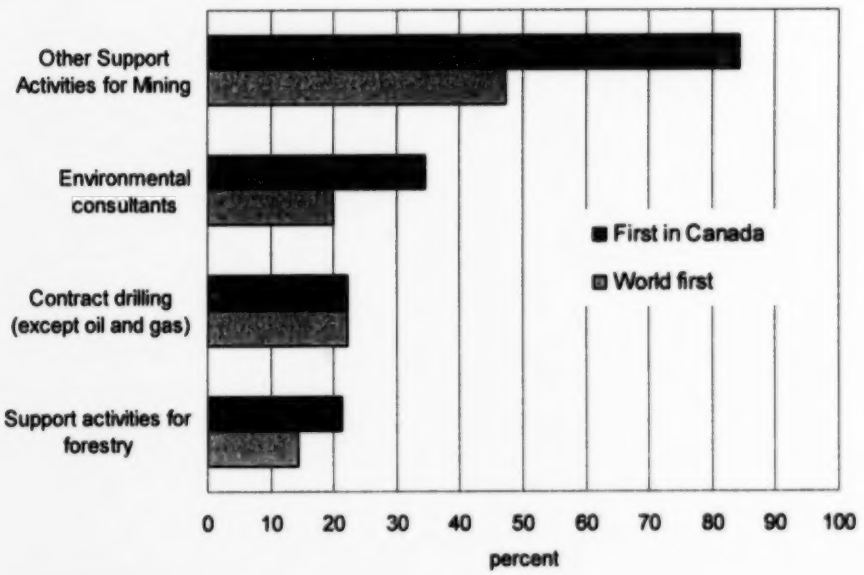
Novelty of innovation

Firms are innovative if they introduce products or processes which are new to the firm. There are, however, degrees of novelty; innovative products or processes may also be new to Canada or even new to the world.

At least one in five innovative establishments in each of the selected industries serving the mining and forestry sectors reported a first in Canada innovation (Figure 4). "Other support activities for mining" had the highest percentage of innovative establishments with Canada-first innovations at 84%.

World-first innovations were also reported in these industries by percentages ranging from just 14% of innovative establishments in "Support activities for forestry" to almost half of the innovative establishments in "Other support activities for mining".

Figure 4
Novelty of new or significantly improved products and/or processes for innovative establishments, 2001 to 2003



Source: *Appendix II, table 3A*

2. How does innovation take place?

This section examines how innovation takes place. It will examine four aspects of innovation: sources of information, innovation activities, who develops innovations and the propensity to engage in cooperative and collaborative arrangements in order to develop innovation.

Sources of information needed for suggesting or contributing to the development of new or significantly improved products or processes may be located within the firm or outside it. The sources outside may arise from working relationships of the firm with its clients, suppliers, consultants, various laboratories and so on. Finally, the information may be generally available to the public.

Innovation can involve a broad range of activities, including engaging in R&D inside the firm, obtaining R&D performed outside the firm, acquisition of equipment and machinery as well as training and market introduction of innovative products.

Innovations can be developed mainly from within the establishment (including the firm the establishment is part of), they can be developed in co-operation with other firms or organizations or they can be developed mainly by other firms or organizations.

Establishments may choose to engage in cooperative or collaborative arrangements to innovate. These arrangements involve the active participation in joint projects between the establishment and other firm and organizations in order to develop new or significantly improved products or processes. Pure contracting out of work, where there is not active collaboration, is not regarded as co-operation.

Sources of information for innovation

Establishments were asked to indicate which sources of information played an important role needed for suggesting or contributing to the development of innovations during the period 2001 to 2003 (Table 3).

Management staff was the most frequently selected internal source of information needed for suggesting or contributing to the development of innovations during the period 2001 to 2003, indeed for two of the four selected industries it was the most frequently indicated source overall.

Suppliers of software, hardware, materials or equipment, and clients or customers were the two external sources of information indicated as being important by the highest percentage of innovative establishments. Beyond these two external sources, each industry seemed to have its own information profile. Establishments in "Support activities for forestry" relied on competitors and universities; "Contract drilling (except oil and gas) looked to competitors; "Other support activities for mining" used consultancy firms; and "Environmental consultants" indicated universities as important sources of information on innovation.

Among the generally available sources of information for innovation, professional conferences, meetings and journals were frequently identified as important sources of information for innovation.

Table 3: Percent of innovative establishments indicating that the source of information played an important[12] role suggesting or contributing to the development of innovations, 2001 to 2003

	Support activities for forestry	Contract drilling (except oil and gas)	Other support activities for mining	Environmental consultants
	%	%	%	%
Internal sources of information for establishment				
Research and development staff	50	33	53	54
Marketing staff	10	22	58	22
Production staff	42	67	63	31
Management staff	50	78*	84*	56
Other business units in firm	16	11	42	31
External sources of information for establishment				
Suppliers of software, hardware, materials, or equipment	63*	67	58	26
Clients or customers	47	67	63	64
Consultancy firms	18	22	53	23
Competitors and other enterprises from same industry	29	56	21	23
Universities or other higher education institutes	23	0	16	44
Federal government research laboratories	12	0	5	22
Provincial/territorial government research laboratories	0	0	5	14
Private non-profit research laboratories	13	0	0	6
Generally available sources of information for establishment				
Professional conferences, meetings, journals	42	22	53	66*
Trade fairs and exhibitions	13	44	42	53
Trade associations	31	44	16	29
Internet	39	11	37	34

Note: The overall most frequently indicated source for each industry is indicated with an asterisk, while the most frequently indicated source by category is highlighted.
Source: *Appendix II, tables 4A, 5A and 6A*

12. Respondents were asked to indicate the importance of a series of 18 sources of information for innovation using a scale of 1 to 5, where 1 is low importance and 5 is high importance. "Important" was indicated by a response of 4 or 5. Respondents could also indicate 0, which indicated the source of information is not relevant.

Innovation activities

Firms were asked to identify the types of innovation activities in which they engaged (Table 4). Two of the innovation activities were frequently selected by establishments in all of the selected industries serving the mining and/or forestry sectors.

Firstly, acquisition of equipment and machinery with improved performance (including integrated software) that was specifically purchased to implement innovation was indicated most frequently by establishments in "Contract drilling (except oil and gas)" and "Other support activities for mining".

Secondly, training, including both internal and external training for personnel that was directly aimed at the development and/or introduction of innovations, was the activity indicated most frequently by establishments in "Support activities for forestry" and "Environmental consultants".

Finally, these activities were either the most frequently or second most frequently indicated innovation activities with the exception of establishments in "Other support activity for mining", which indicated that market introduction of innovations was the second most frequently indicated innovation activity.

Table 4: Percentage of innovative establishments engaged in activities linked to product or process innovation, 2001 to 2003

	Internal research and development	External research and development	Acquisition of equipment and machinery	Acquisition of other external knowledge	Training	Market introduction of innovations
	%	%	%	%	%	%
Support activities for forestry	49	32	77	58	83*	38
Contract drilling (except oil and gas)	33	22	78*	33	67	22
Other support activities for mining	68	58	90*	53	74	79
Environmental consultants	69	50	60	37	79*	73

Note: The two activities indicated by the highest percentage of establishments in each industry are highlighted and the activity the most frequently indicated by the industry has an asterisk.

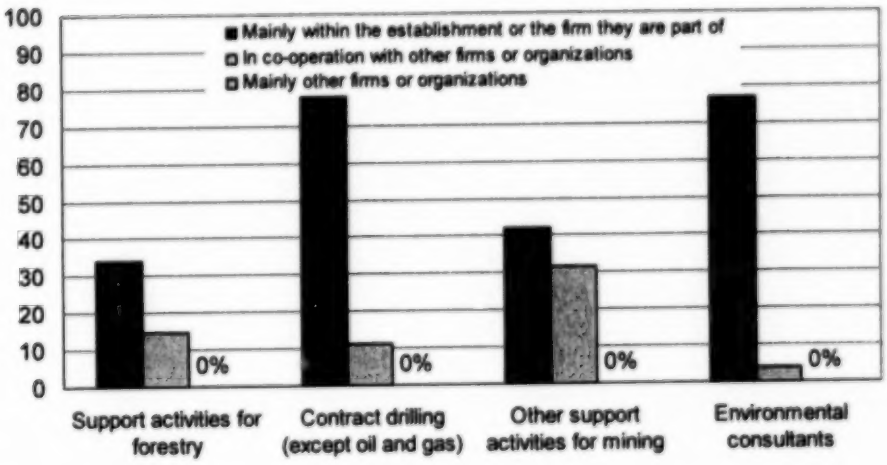
Source: *Appendix II, table 7A*

Where are innovations developed?

Innovations can be developed mainly within the firm, as a result of cooperation with other firms or organizations, or brought into the firm, having been developed mainly by other firms or organizations.

The highest percentage of innovative establishments in all selected industries serving the mining and/or forestry sectors indicated that their product innovations were developed mainly within the establishment or the firm of which the establishment is part (Figure 5). None had product innovations developed mainly by other firms or organizations.

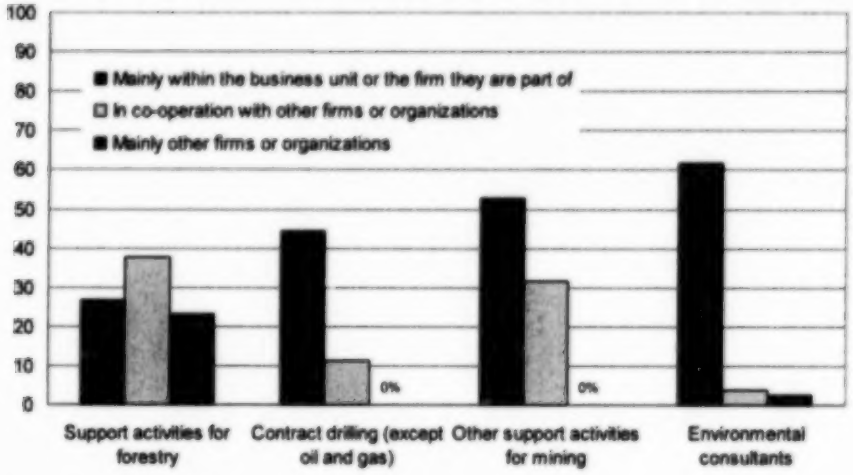
Figure 5
Percentage of innovative establishments indicating who developed their product innovations that were introduced, 2001 to 2003



Source: *Appendix II, table 8A*

Most innovative establishments in all selected industries serving the mining and/or forestry sectors also reported their process innovations were developed mainly within the establishment or the firm that the establishment is part of (Figure 6). The notable exception is for the "Support activities for forestry" industry, where the highest percentage of innovative establishments indicated that process innovations were developed in co-operation with other firms or organizations and the distribution of between the three categories was similar.

Figure 6
Percentage of innovative establishments indicating who developed their process innovations that were introduced, 2001 to 2003

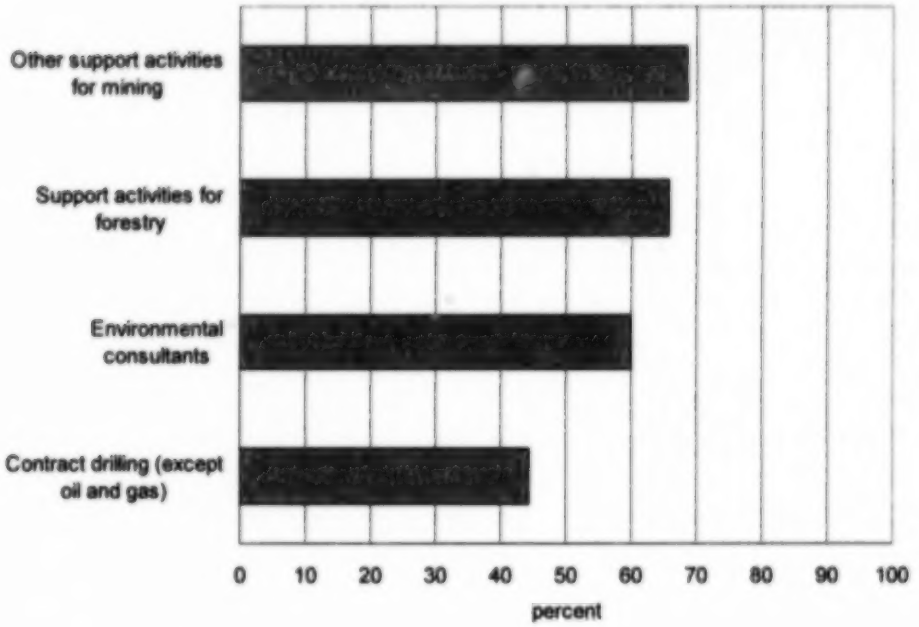


Source: *Appendix II, table 9A*

Innovation collaboration

Despite the fact that more establishments indicated that they developed innovations mainly within the firm, a large proportion of innovative firms indicated that they engaged in cooperative or collaborative arrangements to develop their new or significantly improved products or processes (Figure 7). Propensity to collaborate was lowest for innovative establishments in "Contract drilling (other than oil and gas)" at 44%; and highest for "Other support activities for mining" where almost 70% of innovative establishments reported collaboration.

Figure 7
Percentage of innovative establishments involved in cooperative and collaborative arrangements, 2001 to 2003



Source: *Appendix II, table 10A*

The reasons for engaging in cooperative or collaborative arrangements varied amongst the three industries serving the mining and/or forestry sector for which reliable data were available. Of the eight listed reasons, three reasons were indicated as top two reasons for the three industries. These reasons were: sharing costs, spreading risk, and accessing research and development. Sharing costs was the top reason for both "Support activities for forestry" and "Environmental consultants" (Table 5).

Table 5 – Percentage of innovative establishments[13] involved in cooperative and collaborative arrangements indicating reasons for collaboration, 2001 to 2003

	Support activities for forestry	Other support activities for mining	Environmental consultants
	%	%	%
Sharing costs	82*	39	65*
Spreading risk	71	69*	25
Accessing research and development	45	69*	57
Prototype development	54	62	34
Scaling-up production process	22	15	9
Accessing critical expertise	64	23	41
Accessing new markets	0	54	29
Accessing new distribution channels	6	54	13

Note: The two most frequently indicated innovation activities are highlighted for each industry and the most frequently selected is indicated with an asterisk.
Source: *Appendix II, table 11A*

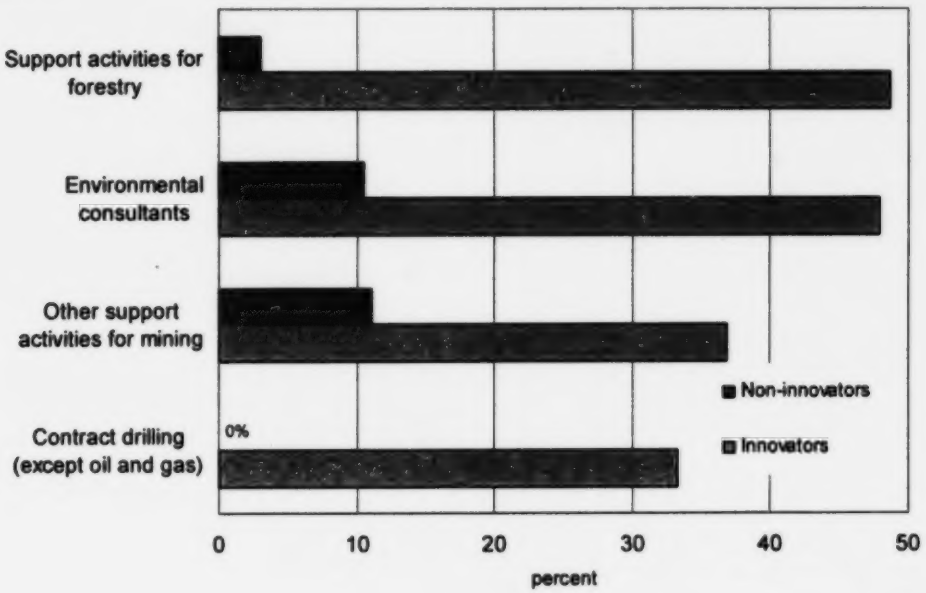
13. Note that data for Contract drilling (except for oil and gas) were not presented in this table as this data is suppressed to meet the confidentiality requirements of the Statistics Act.

Not yet completed or abandoned innovation activities

Some establishments may attempt innovation but not complete the process of bringing the product to market or the process to the factory. The attempted innovation may be abandoned or not yet complete.

Between one third and one half of innovative establishments in each of the selected industries serving the mining and/or forestry sectors reported that they had unsuccessful or not yet completed projects to develop innovations (Figure 8). By contrast, few non-innovative firms indicated that they had even attempted to undertake innovation projects.

Figure 8
Percentage of establishments with unsuccessful or not yet completed projects to develop or introduce new or significantly improved products or processes, 2001 to 2003



Source: *Appendix II, table 12A*

3. What are the obstacles to innovation and the support programs for innovation?

This section will examine the problems and obstacles faced by firms who engage in innovative activities. Engaging in innovation activities requires the allocation of resources, both human and financial, by the establishment or the larger enterprise to which the establishment belongs. Obstacles to innovation can include a lack of such resources and perceived risk with respect to feasibility or market success.

Federal and provincial governments provide a variety of support programs to promote innovation activities. These support programs are intended to help overcome some of the obstacles to innovation, such as the perceived risks of innovation, the difficulty in finding trained staff to undertake innovation activities and the costs involved in innovation activities.

Problems and obstacles to innovation

Innovative establishments were asked to indicate the degree of importance of 13 problems or obstacles which slowed down or caused problems in the innovation process during the period of 2001 to 2003. Obstacles were grouped into three categories: economic, internal and other.

Amongst the three categories of factors, economic factors were indicated by the highest percentage of innovative establishments as important problems and obstacles in all four of the selected industries (see figures with an asterisk in Table 6).

Amongst economic problems and obstacles the one most frequently indicated varied by industry. Risk related to the feasibility of innovative projects was the most commonly indicated obstacle by establishments in "Contract drilling (except oil and gas)" and "Other support activities for mining". "Environmental consultants" indicated costs of innovation were too high, while for "Support activities for forestry" it was a lack of appropriate sources of finance which was the most commonly identified economic problem or obstacle.

Table 6: Percentage of innovative establishments indicating economic factors were important[14] problems and obstacles that slowed down or caused problems when developing innovations, 2001 to 2003

	Risk related to the feasibility of innovative projects	Risk in terms of innovation's market success	Innovation costs too high	Lack of appropriate sources of finance
	%	%	%	%
Support activities for forestry	28	19	47	43*
Contract drilling (except oil and gas)	67*	33	44	33
Other support activities for mining	53*	26	47	32
Environmental consultants	55	56	67*	64

Note: The economic obstacle indicated as being important by the highest percentage of establishments in each industry is highlighted. The asterisk indicates the overall obstacle (economic, internal or other) indicated as important by the highest percentage of establishments in each industry.

Source: *Appendix II, table 13A*

14. Respondents were asked to indicate the importance using a scale of 1 to 5, where 1 is low importance and 5 is high importance. "Important" in the descriptive text portion of this document indicates a response of "4" or "5". In the tables that follow, "High" indicates a response of "5" and "Moderately high" indicates a response of "4". Respondents could also indicate "0", which indicated the factor was not relevant.

Among the internal problems and obstacles (Table 7), the inability to devote staff on an on-going basis due to production requirements was most frequently indicated for two of the four selected industries serving the mining and/or forestry sectors, "Other support activities for mining" and "Environmental consultants". Establishments in "Support activities for forestry" indicated the most frequently experienced internal factor was lack of information on markets, while for establishments in "Contract drilling (except for oil and gas)" it was a lack of qualified personnel.

Table 7: Percentage of innovative establishments indicating internal factors were important[15] problems and obstacles that slowed down or caused problems when developing innovations, 2001 to 2003

	Organizational rigidities within the enterprise	Inability to devote staff on on-going basis due to production requirements	Lack of qualified personnel	Lack of information on technology	Lack of information on markets
	%	%	%	%	%
Support activities for forestry	4	0	2	21	25
Contract drilling (except oil and gas)	22	33	44	0	0
Other support activities for mining	11	26	16	5	11
Environmental Consultants	8	64	5	8	16

Note: The internal obstacle indicated as being important by the highest percentage of establishments in each industry is highlighted.

Source: *Appendix II, table 14A*

15. Respondents were asked to indicate the importance using a scale of 1 to 5, where 1 is low importance and 5 is high importance. "Important" in the descriptive text portion of this document indicates a response of "4" or "5". In the tables that follow, "High" indicates a response of "5" and "Moderately high" indicates a response of "4". Respondents could also indicate "0", which indicated the factor was not relevant.

Amongst the "Other factors" (Table 8), for all four of the selected industries serving the mining and/or forestry sectors, insufficient flexibility of regulations was the most frequently indicated important problem, with lack of customer responsiveness and lack of industry wide-standards equally indicated by "Other support activities for mining".

Table 8: Percentage of innovative establishments indicating other factors were important[16] problems and obstacles that slowed down or caused problems when developing innovations, 2001 to 2003

	Insufficient flexibility of regulations or standards	Lack of customer responsiveness to new goods or services	Lack of industry-wide standards	Lack of regulations in e-commerce as obstacle to exporting innovative products
	%	%	%	%
Support activities for forestry	26	23	12	0
Contract drilling (except oil and gas)	33	0	0	11
Other support activities for mining	16	16	16	5
Environmental consultants	19	31	15	0

Note: The "other" obstacle indicated as being important by the highest percentage of establishments is highlighted.

Source: *Appendix II, table 15A*

16. Respondents were asked to indicate the importance using a scale of 1 to 5, where 1 is low importance and 5 is high importance. "Important" in the descriptive text portion of this document indicates a response of "4" or "5". In the tables that follow, "High" indicates a response of "5" and "Moderately high" indicates a response of "4". Respondents could also indicate "0", which indicated the factor was not relevant.

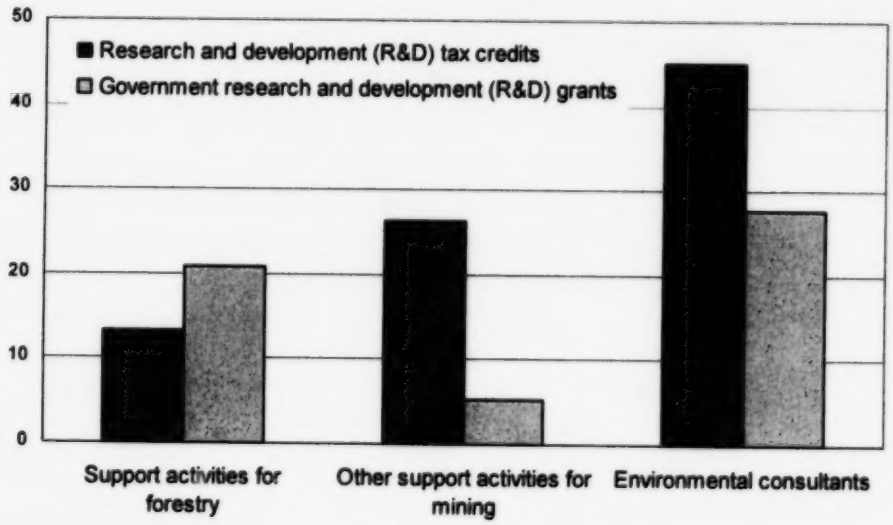
Government Support Programs

Government support programs generally fall into two categories: those that are designed to encourage R&D activities and other support programs.

Among the government R&D support programs, R&D tax credits was the program used by the highest percentage of innovative establishments with the exception of "Support activities for forestry", where R&D grants are more common (Figure 9).

Figure 9
Percentage of innovative establishments[17] using government R&D support programs, 2001 to 2003

%

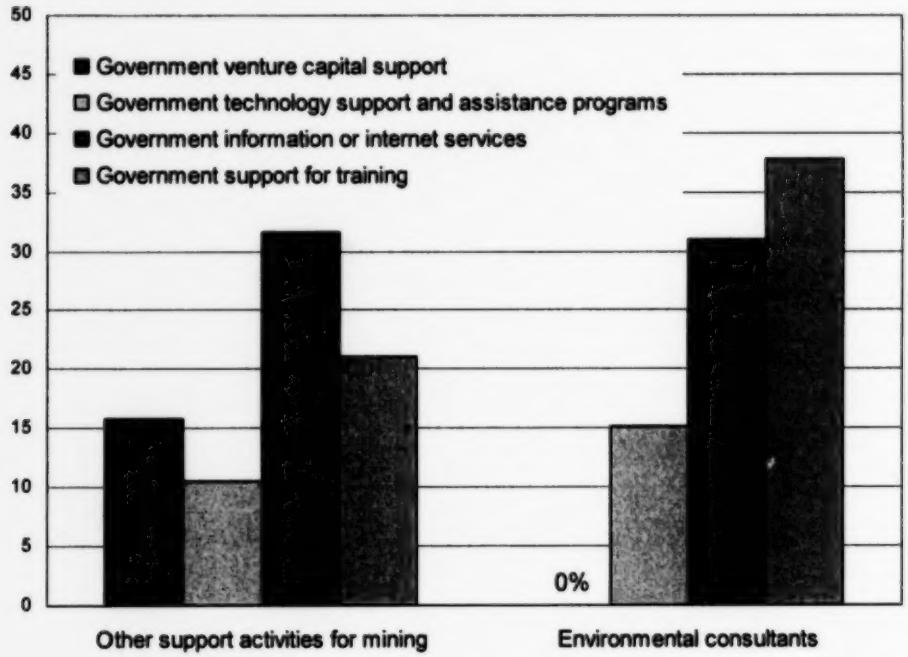


Source: *Appendix II, table 16A*

17. Note that no reliable data were available for "Contract drilling (except oil and gas)".

The four non-R&D government support programs, included venture capital support, technology support and assistance, information or Internet services and support for training. Of these four government support programs, government information and Internet services were the programs indicated as having been used from 2001 to 2003 by the highest percentage industries serving the mining and/or forestry sectors (Figure 10).

Figure 10
Percentage of innovative establishments[18] indicating that they used government support programs, 2001 to 2003



Source: *Appendix II, table 16A*

18. Note that no reliable data were available for "Contract drilling (except oil and gas)"and "Support activities for forestry".

4. What are the impacts of innovation?

This section will examine the impacts of innovation. Firms were asked to indicate the importance of 10 possible impacts of innovation. Four impacts accounted for the top three most frequently selected for all selected industries serving the mining and/or forestry sectors.

Allowing firms to keep up with competitors was amongst the top three impacts for all of the selected industries serving the mining and forestry sectors. Other frequently indicated impacts were improved quality of products (goods or services), increased ability to adapt flexibly to different client demands, increased productivity and increased profitability.

Table 9: Percentage of innovative establishments that agreed[19] to the impact resulting from the development and introduction of innovations, 2001 to 2003

Impact	Support activities for forestry		Contract drilling (except oil and gas)		Other support activities for mining		Environmental consultants	
	%	rank	%	rank	%	rank	%	rank
Improved the quality of products (goods or services)	69*	1	78*	1	68	2	77	2
Allowed establishment to keep up with its competitors	66	2	78*	1	63	3	85*	1
Increased the ability to adapt flexibly to different client demands	64	3	78*	1	79*	1	71	3
Increased the business unit's productivity	35	5	67	4	68	2	60	5

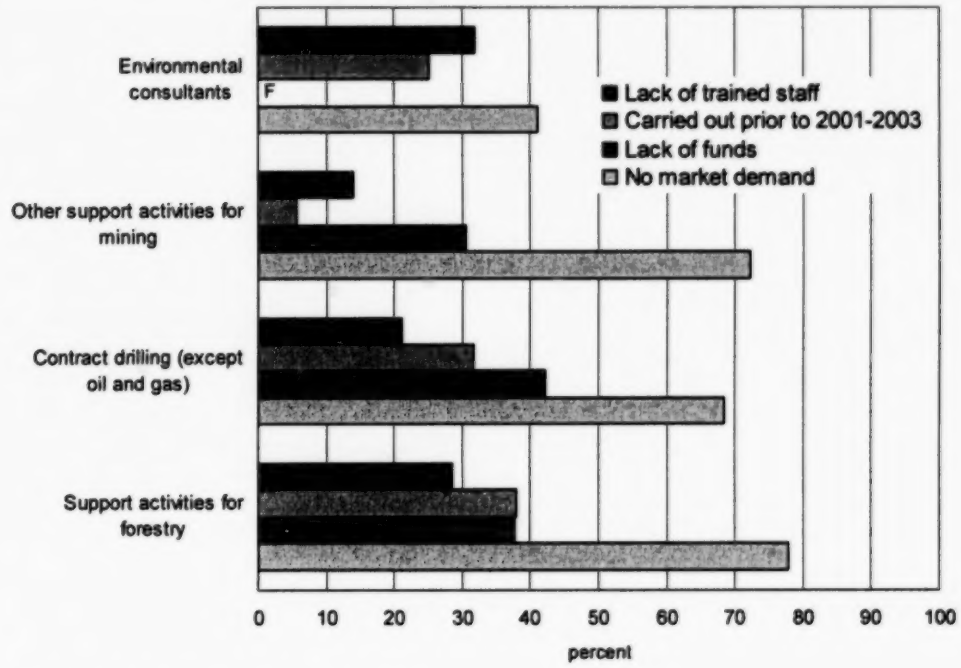
Note: The top three impacts agreed to by the highest percentage of establishments in each industry are highlighted and the activity the most frequently indicated by each industry has an asterisk. See table 17A for all data on all impacts.
Source: *Appendix II, table 17A*

19. Establishments were asked whether or not they agreed with statements describing impacts of innovation. "Agree" indicates that they responded by selecting "4" or "5", while "Strongly agree" indicates that they selected "5" and "Not relevant" indicates that they selected "0".

5. Why do some establishments choose not to innovate?

Non-innovative establishments were asked why they chose not to innovate. Lack of market demand is the reason chosen by the largest percentage of non-innovative establishments as an explanation of why they did not develop or introduce any new or significantly improved products or process during the period 2001 to 2003. This was indicated by at least 40% of all establishments in each industry (Figure 11).

Figure 11
Reasons why non-innovative establishments did not develop or introduce any new or significantly improved products or processes, 2001 to 2003



Note: F – suppressed because no reliable data are available.
Source: *Appendix II, table 18A*

References

Anderson, Frances and Susan Schaan (2003), "Innovation in the Forest Sector", *Forestry Chronicle*, Volume 78, pp. 60-63.

OECD/Eurostat (1997), *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data (Oslo Manual)*. Paris: OECD.

Schaan, Susan (2003), "An Innovation System for the Forest Sector" in Gault, Fred (Ed.), *Understanding Innovation in Canadian Industry*. Montreal and Kingston: McGill-Queen's University Press, pp.367-386, Ottawa: Statistics Canada.

Statistics Canada (2003), *North American Industry Classification System: Canada 2002*. Catalogue no. 12-501-XPE. Ottawa: Statistics Canada.

Appendix I: Description of the industries serving mining and/or forestry sectors

All establishments and enterprises in Canada are defined according to a classification system called the North American Industry Classification System (NAICS)[20]. This standard was revised in 2002, and it is this revised version which was used for the Survey of Innovation 2003.

NAICS 1153 - Support activities for forestry - This Canadian industry comprises establishments primarily engaged in performing particular support activities, related to harvesting timber. Examples of activities which would be covered by this industry classification include: Cruising timber; Forest fire fighting services; Log hauling in the bush (i.e., within the logging limits); Pest control services, forestry; Reforestation services; Timber cruising; Timber valuation.

NAICS 213117 - Contract drilling (except oil and gas) - This Canadian industry comprises establishments primarily engaged in diamond, test, prospect and other types of drilling, for minerals, other than oil and gas. Examples of activities which would be covered by this industry classification include: Boring test holes for non-metallic minerals mining (except fuels), on contract basis; Contract diamond drilling, metallic minerals; Drilling services for non-metallic minerals mining (except fuels), on a contract basis; Iron ore mine diamond drilling, contract services; Metal mining, prospect drilling for, on a contract basis; Prospect drilling for metal mining, on a contract basis; Prospect drilling for non-metallic minerals (except fuels), on contract basis; Test drilling for metal mining, on a contract basis; Test drilling for non-metallic minerals mining (except fuels), on a contract basis.

NAICS 213119 - Other support activities for mining - This Canadian industry comprises establishments, not classified to any other Canadian industry, primarily engaged in performing mining services, for others, on a contract or fee basis. Establishments engaged in the exploration for minerals are included. Such exploration is often accomplished using purchased services of specialty businesses, such as contract drilling services to obtain core samples. Examples of activities which would be covered by this industry classification include: Draining or pumping of mines, on a contract basis; Overburden removal, prior to working minerals, in quarries and open pit mines; Stripping services, coal and lignite, on a contract basis; Tunnelling, coal and lignite mining, on a contract basis. This category excludes: performing geophysical surveying services for oil and gas, on a contract or fee basis which is covered by 541360, Geophysical Surveying and Mapping Services.

NAICS 54162 - Environmental Consultants - This industry comprises establishments primarily engaged in providing advice and assistance to other organizations on environmental issues, such as the control of environmental contamination from pollutants, toxic substances and hazardous materials. These establishments identify problems, measure and evaluate risks, and recommend solutions. They employ a multi-disciplined staff of scientists, engineers and other technicians, with expertise in areas such as air and water quality, asbestos contamination, remediation and environmental law. Examples of establishments in this industry are environmental consultants, sanitation consultants and site remediation consultants. Exclusions consist of establishments primarily engaged in: providing environmental engineering services (54133, Engineering Services); and environmental remediation (56291, Remediation Services).

20. Source: http://www.statcan.ca/english/concepts/industry.htm

Appendix II: Detailed Data Tables

The reliability of the data is reported using the following symbol convention (Table A and B) for quality indicator interpretation. This convention combines the effect of sampling (since we did not do a census) and the imputation rate.

Quality Indicators

Table A: Coefficient of Variation

	Imputation Rate			
CV	**< 15%**	**≥ 15% and < 35%**	**≥ 35% and < 50%**	**≥ 50%**
≤ 5.0%	A	B	E	F
> 5.0% and ≤ 15.0%	B	E	F	F
> 15.0% and ≤ 30.0%	E	F	F	F
> 30.0%	F	F	F	F

Table B: Standard Error

	Imputation Rate			
Standard Error	**< 15%**	**≥ 15% and < 35%**	**≥ 35% and < 50%**	**≥ 50%**
≤2.5%	A	B	E	F
>2.5% and ≤7.5%	B	E	F	F
>7.5 and ≤15.0%	E	F	F	F
>15.0%	F	F	F	F

Estimates with a quality indicator of A are very reliable.
Estimates with a quality indicator of B are reliable.
Estimates with a quality indicator of E are to be used with caution.
Estimates with a quality indicator of F have very poor reliability and have been suppressed.

Measures of importance and agreement

For Tables 4, 5, 6, 13, 14 and 15, establishments were asked to indicate the importance of various factors in question, be it sources of information, problems and obstacles, etc. Respondents were asked to indicate the importance using a scale of 1 to 5, where 1 is low importance and 5 is high importance. "Important" in the descriptive text portion of this document indicates a response of "4" or "5". In the tables that follow, "High" indicates a response of "5" and "Moderately high" indicates a response of "4". Respondents could also indicate "0", which indicated the factor was not relevant.

For Table 17, establishments were asked whether or not they agreed with statements describing impacts of innovation. "Agree" indicates that they responded by selecting "4" or "5", while "Strongly agree" indicates that they selected "5" and "Not relevant" indicates that they selected "0".

Statistical Unit

The questionnaire was directed to establishments. "The establishment is the level at which the accounting data required to measure production is available (principal inputs, revenues, salaries and wages). The establishment, as a statistical unit, is defined as the most homogeneous unit of production for which the business maintains accounting records from which it is possible to assemble all the data elements required to compile the full structure of the gross value of production (total sales or shipments, and inventories), the cost of materials and services, and labour and capital used in production."[21] In the questionnaire, establishments were referred to as "business units" as this terminology was found to be more familiar to respondents completing the survey. Establishments were also asked whether or not they belonged to larger firms, which corresponds to the statistical concept of the enterprise.

Note: A complete set of data comprising over one thousand tables for Canada and all provinces and territories is available on a CD-ROM entitled Survey of Innovation, 2003, catalogue number 88-524-XCB.

21. Source: http://www.statcan.ca/english/concepts/stat-unit-def.htm

Table 1A: Percentage of innovative establishments, 2001 to 2003

	Innovators	
	%	Reliability
Support activities for forestry	28.7	B
Contract drilling (except oil and gas)	32.1	B
Other support activities for mining	34.5	B
Environmental consultants	67.3	B

Table 2A: Percentage of types of innovative establishments, 2001 to 2003

	Innovators		Product Innovators		Process Innovators	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	100.0	A	48.6	E	87.4	B
Contract drilling (except oil and gas)	100.0	A	88.9	B	55.6	E
Other support activities for mining	100.0	A	73.7	B	84.2	B
Environmental consultants	100.0	A	80.5	B	68.2	B

Table 2A (con't): Percentage of types of innovative establishments, 2001 to 2003

	Both Product and Process Innovators		Product Innovators Only		Process Innovators Only	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	36.0	E	12.6	B	51.4	E
Contract drilling (except oil and gas)	44.4	E	44.4	E	11.1	B
Other support activities for mining	57.9	B	15.8	B	26.3	B
Environmental consultants	48.7	B	31.8	B	19.5	B

Table 3A: Novelty of new or significantly improved products (goods or services) and/or processes, 2001 to 2003

	First in Canada		World first	
	%	Reliability	%	Reliability
Support activities for forestry	21.3	B	14.3	B
Contract drilling (except oil and gas)	22.2	E	22.2	E
Other Support Activities for Mining	84.2	B	47.4	B
Environmental consultants	34.6	B	19.9	B

Table 4A: Percentage of innovative establishments using internal sources of information needed for suggesting or contributing to the development of innovation, 2001 to 2003

	Importance					
	Moderately high		High		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Research and development staff	33.8	E	16.1	B	50.1	E
Marketing staff	10.4	B	0.0	A	65.1	E
Production staff	29.3	B	12.8	B	53.8	E
Management staff	25.8	B	24.1	B	6.3	B
Other business units in firm	16.3	B	0.0	A	69.0	E
Contract drilling (except oil and gas)						
Research and development staff	33.3	E	0.0	A	11.1	B
Marketing staff	22.2	E	0.0	A	0.0	A
Production staff	66.7	E	0.0	A	0.0	A
Management staff	55.6	E	22.2	E	0.0	A
Other business units in firm	0.0	A	11.1	B	33.3	E
Other support activities for mining						
Research and development staff	26.3	B	26.3	B	21.1	B
Marketing staff	31.6	B	26.3	B	10.5	B
Production staff	42.1	B	21.1	B	10.5	B
Management staff	47.4	B	36.8	B	0.0	A
Other business units in firm	21.1	B	21.1	B	26.3	B
Environmental consultants						
Research and development staff	25.5	B	28.2	B	11.3	B
Marketing staff	19.5	B	2.6	A	8.8	B
Production staff	21.4	B	9.4	B	11.6	B
Management staff	37.4	B	18.1	B	0.0	A
Other business units in firm	20.9	B	10.5	B	26.7	B

Table 5A: Percentage of innovative establishments using external sources of information needed for suggesting or contributing to the development of innovation, 2001 to 2003

	Importance					
	Moderately high		High		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Suppliers of software, hardware, materials, or equipment	56.4	E	7.0	B	6.3	B
Clients or customers	42.1	E	4.9	A	19.0	E
Consultancy firms	16.3	B	2.1	A	41.6	E
Competitors and other enterprises from same industry	16.6	B	12.7	B	14.3	B
Universities or other higher education institutes	13.3	B	9.2	B	24.0	E
Federal government research laboratories	8.0	B	4.2	B	40.3	E
Provincial/territorial government research laboratories	0.0	A	0.0	A	43.8	E
Private non-profit research laboratories	13.3	B	0.0	A	48.3	E
Contract drilling (except oil and gas)						
Suppliers of software, hardware, materials, or equipment	44.4	E	22.2	E	0.0	A
Clients or customers	44.4	E	22.2	E	0.0	A
Consultancy firms	0.0	A	22.2	E	11.1	B
Competitors and other enterprises from same industry	55.6	E	0.0	A	0.0	A
Universities or other higher education institutes	0.0	A	0.0	A	11.1	B
Federal government research laboratories	0.0	A	0.0	A	22.2	E
Provincial/territorial government research laboratories	0.0	A	0.0	A	22.2	E
Private non-profit research laboratories	0.0	A	0.0	A	33.3	E
Other support activities for mining						
Suppliers of software, hardware, materials, or equipment	31.6	B	26.3	B	5.3	B
Clients or customers	36.8	B	26.3	B	10.5	B
Consultancy firms	26.3	B	26.3	B	5.3	B
Competitors and other enterprises from same industry	21.1	B	0.0	A	10.5	B
Universities or other higher education institutes	10.5	B	5.3	B	15.8	B
Federal government research laboratories	5.3	B	0.0	A	31.6	B
Provincial/territorial government research laboratories	5.3	B	0.0	A	36.8	B
Private non-profit research laboratories	0.0	A	0.0	A	31.6	B
Environmental consultants						
Suppliers of software, hardware, materials, or equipment	21.2	B	5.1	A	13.8	B
Clients or customers	35.4	B	29.0	B	3.7	B
Consultancy firms	18.0	B	4.8	A	13.8	B
Competitors and other enterprises from same industry	23.0	B	0.0	A	8.7	B
Universities or other higher education institutes	41.1	B	2.5	A	8.7	B
Federal government research laboratories	17.8	B	4.4	A	11.3	B
Provincial/territorial government research laboratories	9.4	B	4.4	A	13.5	B
Private non-profit research laboratories	1.8	A	4.4	A	23.6	B

Table 6A: Percentage of innovative establishments using generally available sources of information needed for suggesting or contributing to the development of innovation, 2001 to 2003

	Importance					
	Moderately high		High		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Professional conferences, meetings, journals	22.6	E	19.1	B	21.2	E
Trade fairs and exhibitions	13.3	B	0.0	A	21.2	E
Trade associations	26.3	B	4.2	B	21.2	E
Internet	38.7	E	0.0	A	19.0	E
Contract drilling (except oil and gas)						
Professional conferences, meetings, journals	11.1	B	11.1	B	0.0	A
Trade fairs and exhibitions	44.4	E	0.0	A	0.0	A
Trade associations	44.4	E	0.0	A	11.1	B
Internet	0.0	A	11.1	B	0.0	A
Other support activities for mining						
Professional conferences, meetings, journals	21.1	B	31.6	B	0.0	A
Trade fairs and exhibitions	21.1	B	21.1	B	0.0	A
Trade associations	15.8	B	0.0	A	0.0	A
Internet	21.1	B	15.8	B	0.0	A
Environmental consultants						
Professional conferences, meetings, journals	43.6	B	22.1	B	3.7	B
Trade fairs and exhibitions	41.9	B	10.6	B	8.8	B
Trade associations	24.8	B	4.6	A	3.7	B
Internet	14.2	B	19.5	B	3.7	B

Table 7A: Percentage of innovative establishments engaged in activities linked to product or process innovation, 2001 to 2003

	Internal research and development		External research and development		Acquisition of equipment and machinery	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	49.3	E	31.7	E	76.5	E
Contract drilling (except oil and gas)	33.3	E	22.2	E	77.8	E
Other support activities for mining	68.4	B	57.9	B	89.5	B
Environmental consultants	68.6	B	49.9	B	60.1	B

Table 7A (con't): Percentage of innovative establishments engaged in activities linked to product or process innovation, 2001 to 2003

	Acquisition of other external knowledge		Training		Market introduction of innovations	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	57.5	E	82.9	B	37.7	E
Contract drilling (except oil and gas)	33.3	E	66.7	E	22.2	E
Other support activities for mining	52.6	B	73.7	B	78.9	B
Environmental consultants	36.9	B	79.0	B	72.7	B

Table 8A : Percentage of innovative establishments indicating where their product innovations that were introduced during the period 2001 to 2003, were developed

	Mainly within the establishment or the firm they are part of		In co-operation with other firms or organizations		Mainly other firms or organizations	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	33.9	E	14.7	B	0.0	A
Contract drilling (except oil and gas)	77.8	E	11.1	B	0.0	A
Other support activities for mining	42.1	B	31.6	B	0.0	A
Environmental consultants	76.8	B	3.7	A	0.0	A

Table 9A: Percentage of innovative establishments indicating where their process innovations that were introduced during the period 2001 to 2003, were developed

	Mainly within the establishment or the firm they are part of		In co-operation with other firms or organizations		Mainly other firms or organizations	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	26.6	E	37.6	E	23.1	E
Contract drilling (except oil and gas)	44.4	E	11.1	B	0.0	A
Other support activities for mining	52.6	B	31.6	B	0.0	A
Environmental consultants	61.7	B	4.0	A	2.5	A

Table 10A: Percentage of innovative establishments involved in cooperative and collaborative arrangements, 2001 to 2003

	Establishments in collaborative arrangements	
	%	Reliability
Contract drilling (except oil and gas)	44.4	E
Environmental consultants	59.7	B
Support activities for forestry	65.6	E
Other support activities for mining	68.4	B

Table 11A: Percentage of innovative establishments in cooperative or collaborative arrangements indicating reasons for involvement in cooperative and collaborative arrangements, 2001 to 2003

	Sharing costs		Spreading risk		Accessing research and development		Prototype development	
	%	Reliability	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	81.5	E	70.8	E	44.7	E	53.9	E
Contract drilling (except oil and gas)	x	E	x	E	x	E	x	E
Other support activities for mining	38.5	B	69.2	B	69.2	B	61.5	B
Environmental consultants	65.0	B	25.4	B	56.6	B	33.8	B

Table 11A (con't): Percentage of innovative establishments in cooperative or collaborative arrangements indicating reasons for involvement in cooperative and collaborative arrangements, 2001 to 2003

	Scaling-up production process		Accessing critical expertise		Accessing new markets		Accessing new distribution channels	
	%	Reliability	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	22.4	E	63.7	E	0.0	A	6.3	B
Contract drilling (except oil and gas)	x	A	x	A	x	E	x	E
Other support activities for mining	15.4	B	23.1	B	53.8	B	53.8	B
Environmental consultants	9.0	B	40.9	B	28.9	B	13.3	B

Table 12A: Percentage of establishments with unsuccessful or not yet completed projects to develop or introduce new or significantly improved products (goods or services) or processes (including improved ways of delivering goods or services), 2001 to 2003

	All		Innovators		Non-innovators	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	16.1	B	48.7	E	3.0	A
Contract drilling (except oil and gas)	10.7	B	33.3	E	0.0	A
Other support activities for mining	20.0	B	36.8	B	11.1	B
Environmental consultants	35.7	B	47.9	B	10.5	B

Table 13A: Percentage of innovative establishments with economic problems and obstacles that slowed down or caused problems when developing new or significantly improved products or processes, 2001 to 2003

	Importance					
	Moderately high		High		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Risk related to the feasibility of innovative projects	8.6	B	19.7	B	33.3	E
Risk in terms of innovation's market success	14.7	B	4.5	A	29.1	E
Innovation costs too high	17.5	B	29.5	E	10.5	B
Lack of appropriate sources of finance	2.8	A	40.0	E	12.6	B
Contract drilling (except oil and gas)						
Risk related to the feasibility of innovative projects	55.6	E	11.1	B	0.0	A
Risk in terms of innovation's market success	33.3	E	0.0	A	33.3	E
Innovation costs too high	33.3	E	11.1	B	0.0	A
Lack of appropriate sources of finance	33.3	E	0.0	A	0.0	A
Other support activities for mining						
Risk related to the feasibility of innovative projects	47.4	B	5.3	B	0.0	A
Risk in terms of innovation's market success	10.5	B	15.8	B	15.8	B
Innovation costs too high	36.8	B	10.5	B	0.0	A
Lack of appropriate sources of finance	21.1	B	10.5	B	0.0	A
Environmental consultants						
Risk related to the feasibility of innovative projects	39.7	B	15.6	B	9.5	B
Risk in terms of innovation's market success	37.8	B	18.6	B	7.7	B
Innovation costs too high	56.2	B	10.8	B	7.7	B
Lack of appropriate sources of finance	42.6	B	21.1	B	12.7	B

Note: Respondents were asked to indicate the importance of a series of 13 problems and obstacles to innovation using a scale of 1 to 5, where 1 is low importance and 5 is high importance. "Important" was indicated by a response of 4 or 5. Respondents could also indicate 0, which indicated the source of information is not relevant.

Table 14A: Percentage of innovative establishments with internal problems and obstacles that slowed down or caused problems when developing new or significantly improved products or processes, 2001 to 2003

	Importance					
	Moderately high		High		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Organizational rigidities within the enterprise	0.0	A	4.2	B	29.1	E
Inability to devote staff on on-going basis due to production requirements	0.0	A	0.0	A	29.1	E
Lack of qualified personnel	0.0	A	2.1	A	12.7	B
Lack of information on technology	16.8	B	4.2	B	27.0	E
Lack of information on markets	16.8	B	8.6	B	37.5	E
Contract drilling (except oil and gas)						
Organizational rigidities within the enterprise	22.2	E	0.0	A	33.3	E
Inability to devote staff on on-going basis due to production requirements	33.3	E	0.0	A	0.0	A
Lack of qualified personnel	33.3	E	11.1	B	0.0	A
Lack of information on technology	0.0	A	0.0	A	0.0	A
Lack of information on markets	0.0	A	0.0	A	33.3	E
Other support activities for mining						
Organizational rigidities within the enterprise	10.5	B	0.0	A	15.8	B
Inability to devote staff on on-going basis due to production requirements	21.1	B	5.3	B	5.3	B
Lack of qualified personnel	10.5	B	5.3	B	5.3	B
Lack of information on technology	5.3	B	0.0	A	0.0	A
Lack of information on markets	10.5	B	0.0	A	15.8	B
Environmental consultants						
Organizational rigidities within the enterprise	7.9	B	0.0	A	9.5	B
Inability to devote staff on on-going basis due to production requirements	56.7	B	7.2	B	9.5	B
Lack of qualified personnel	0.0	A	4.9	A	7.0	A
Lack of information on technology	8.1	B	0.0	A	12.0	B
Lack of information on markets	4.3	A	11.7	B	9.5	B

Table 15A: Percentage of innovative establishments with other types of problems and obstacles that slowed down or caused problems when developing new or significantly improved products or processes, 2001 to 2003

	Importance					
	Moderately high		High		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Insufficient flexibility of regulations or standards	0.0	A	25.5	E	2.1	A
Lack of customer responsiveness to new goods or services	9.2	B	13.6	B	27.0	E
Lack of industry-wide standards	9.2	B	2.8	A	18.5	B
Lack of regulations in e-commerce as obstacle to exporting innovative products	0.0	A	0.0	A	29.8	E
Contract drilling (except oil and gas)						
Insufficient flexibility of regulations or standards	33.3	E	0.0	A	0.0	A
Lack of customer responsiveness to new goods or services	0.0	A	0.0	A	33.3	E
Lack of industry-wide standards	0.0	A	0.0	A	44.4	E
Lack of regulations in e-commerce as obstacle to exporting innovative products	11.1	B	0.0	A	44.4	E
Other support activities for mining						
Insufficient flexibility of regulations or standards	10.5	B	5.3	B	15.8	B
Lack of customer responsiveness to new goods or services	0.0	A	15.8	B	15.8	B
Lack of industry-wide standards	10.5	B	5.3	B	15.8	B
Lack of regulations in e-commerce as obstacle to exporting innovative products	5.3	B	0.0	A	26.3	B
Environmental consultants						
Insufficient flexibility of regulations or standards	16.7	B	2.5	A	25.7	B
Lack of customer responsiveness to new goods or services	28.5	B	2.6	A	10.1	B
Lack of industry-wide standards	10.3	B	4.4	A	19.9	B
Lack of regulations in e-commerce as obstacle to exporting innovative products	0.0	A	0.0	A	34.4	B

Table 16A: Percentage of innovative establishments that used support programs of the federal or provincial/territorial governments between 2001 and 2003

	Government programs				Did not use government program	
	Federal government		Provincial/territorial government			
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Research and development (R&D) tax credits	13.3	E	13.3	E	86.7	E
Government research and development (R&D) grants	10.0	E	10.8	E	79.2	E
Government venture capital support	0.0	B	4.2	E	95.8	E
Government technology support and assistance programs	0.0	B	F	F	F	F
Government information or internet services	F	F	F	F	F	F
Government support for training	19.6	E	10.4	E	72.1	E
Contract drilling (except oil and gas)						
Research and development (R&D) tax credits	F	F	F	F	F	F
Government research and development (R&D) grants	F	F	0.0	B	F	F
Government venture capital support	0.0	B	F	F	F	F
Government technology support and assistance programs	0.0	B	0.0	B	100.0	B
Government information or internet services	11.1	E	11.1	E	F	F
Government support for training	0.0	B	F	F	F	F
Other support activities for mining						
Research and development (R&D) tax credits	26.3	E	15.8	E	73.7	E
Government research and development (R&D) grants	5.3	E	0.0	B	94.7	E
Government venture capital support	0.0	B	15.8	E	84.2	E
Government technology support and assistance programs	10.5	E	0.0	B	89.5	E
Government information or internet services	26.3	E	21.1	E	68.4	E
Government support for training	5.3	E	15.8	E	78.9	E
Environmental consultants						
Research and development (R&D) tax credits	45.0	E	29.9	E	55.0	E
Government research and development (R&D) grants	22.1	E	8.3	E	72.2	E
Government venture capital support	0.0	B	0.0	B	100.0	B
Government technology support and assistance programs	11.6	E	6.2	B	84.8	E
Government information or internet services	31.0	E	22.3	E	69.0	E
Government support for training	21.3	E	20.7	E	62.2	E

Table 17A: Percentage of establishments that had an impact from new or significantly improved products or processes developed and introduced, 2001 to 2003

	Agree		Strongly agree		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry						
Increased the business unit's productivity	34.6	E	23.8	E	18.5	B
Increased the business unit's profitability	12.8	B	0.0	A	14.3	B
Increased the speed of supplying and/or delivering services or goods	53.4	E	21.0	E	18.5	B
Increased the ability to adapt flexibly to different client demands	63.9	E	16.8	B	18.5	B
Increased business unit's domestic market share	32.1	E	11.1	B	29.1	E
Increased business unit's international market share	2.1	A	0.0	A	67.6	E
Allowed business unit to maintain its profit margins	21.6	B	9.2	B	14.3	B
Allowed business unit to keep up with its competitors	65.8	E	28.0	E	18.5	B
Decreased the cost of producing products (goods or services)	15.3	B	0.0	A	18.6	B
Improved the quality of products (goods or services)	68.7	E	28.0	E	29.1	E
Contract drilling (except oil and gas)						
Increased the business unit's productivity	66.7	E	11.1	B	0.0	A
Increased the business unit's profitability	55.6	E	22.2	E	0.0	A
Increased the speed of supplying and/or delivering services or goods	22.2	E	11.1	B	0.0	A
Increased the ability to adapt flexibly to different client demands	77.8	E	22.2	E	0.0	A
Increased business unit's domestic market share	44.4	E	0.0	A	0.0	A
Increased business unit's international market share	22.2	E	0.0	A	55.6	E
Allowed business unit to maintain its profit margins	55.6	E	0.0	A	0.0	A
Allowed business unit to keep up with its competitors	77.8	E	22.2	E	0.0	A
Decreased the cost of producing products (goods or services)	11.1	B	0.0	A	33.3	E
Improved the quality of products (goods or services)	77.8	E	0.0	A	0.0	A
Other support activities for mining						
Increased the business unit's productivity	68.4	B	31.6	B	5.3	B
Increased the business unit's profitability	57.9	B	26.3	B	5.3	B
Increased the speed of supplying and/or delivering services or goods	52.6	B	31.6	B	10.5	B
Increased the ability to adapt flexibly to different client demands	78.9	B	36.8	B	10.5	B
Increased business unit's domestic market share	52.6	B	10.5	B	10.5	B
Increased business unit's international market share	21.1	B	0.0	A	26.3	B
Allowed business unit to maintain its profit margins	36.8	B	10.5	B	10.5	B
Allowed business unit to keep up with its competitors	63.2	B	15.8	B	5.3	B
Decreased the cost of producing products (goods or services)	57.9	B	15.8	B	10.5	B
Improved the quality of products (goods or services)	68.4	B	26.3	B	5.3	B

Table 17A (con't): Percentage of establishments that had an impact from new or significantly improved products or processes developed and introduced, 2001 to 2003

	Agree		Strongly agree		Not relevant	
	%	Reliability	%	Reliability	%	Reliability
Environmental consultants						
Increased the business unit's productivity	59.8	B	24.5	B	2.6	A
Increased the business unit's profitability	60.2	B	17.2	B	0.0	A
Increased the speed of supplying and/or delivering services or goods	42.0	B	8.7	B	9.8	B
Increased the ability to adapt flexibly to different client demands	70.9	B	12.3	B	0.0	A
Increased business unit's domestic market share	61.0	B	15.0	B	2.6	A
Increased business unit's international market share	37.1	B	19.0	B	10.9	B
Allowed business unit to maintain its profit margins	49.6	B	18.7	B	6.8	A
Allowed business unit to keep up with its competitors	84.6	B	29.6	B	0.0	A
Decreased the cost of producing products (goods or services)	26.6	B	12.2	B	11.9	B
Improved the quality of products (goods or services)	76.7	B	26.1	B	4.6	A

Table 18A: Reasons why non-innovative establishments did not develop or introduce any new or significantly improved products or processes, 2001 to 2003

	Carried out prior to 2001-2003		No market demand		Lack of funds		Lack of trained staff		Other reasons	
	%	Reliability	%	Reliability	%	Reliability	%	Reliability	%	Reliability
Support activities for forestry	37.9	E	77.9	E	37.6	E	28.4	E	5.5	B
Contract drilling (except oil and gas)	31.6	E	68.4	E	42.1	E	21.1	E	5.3	E
Other support activities for mining	5.6	B	72.2	E	30.6	E	13.9	E	11.1	E
Environmental consultants	25.0	E	41.1	E	F	F	31.9	E	0.0	B

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